



# Programmation Android

## I. Introduction



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# Plan

- 1 Introduction
- 2 La plate-forme Android
- 3 Programmation Android
- 4 Hello World avec Android Studio
- 5 Édition du projet avec Android Studio
- 6 Exécution du projet



# Plan

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# Application mobile

▸ wikipédia

## Caractéristiques

- Cible : **appareils électroniques mobiles autonomes** (smartphone, tablette, etc.)
- ⇒ **Contexte logiciel hétérogène** :
  - **non connecté** : pas d'accès réseau / connectivité limitée...
  - **connecté** : LAN / WAN ...
  - **localisé (ou non)** : **GPS**, géolocalisation IP !
  - ...
- ⇒ **Contexte matériel hétérogène** :
  - **ressources plus faibles** : CPU / RAM / DD / ROM
  - ⇒ la **consommation** des ressources doit être **minimale**
  - ⇒ **Résolutions d'affichage hétéroclites** ⇒ **GUI adaptative**
  - ...



# Application mobile

## Principaux OS

- **Android** (Google) : Linux, version 12 (octobre 2021)
- **iOS** (Apple) noyau hybride XNU : Mach(libre) + BSD (Unix)
- **Tizen** (*Linux Foundation*), supporté par Samsung (montres connectées)
- **Librem 5** (*Purism, PureOS*), vie privée / sécurité)
- **Windows 10 mobile** (Microsoft) (arrêté en octobre 2017)
- **Ubuntu Touch** (Canonical) : Linux (arrêté en avril 2017)
- **BlackBerry OS, QNX** : Unix (arrêté en 2015)
- **Firefox OS** (Mozilla Corporation) : Linux (arrêté en 2015)
- [▶ plus d'information](#)



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# Android

## Origine

- Initialement un OS pour appareil photo
- Acheté par Google en 2005
- [► Wikipédia](#)



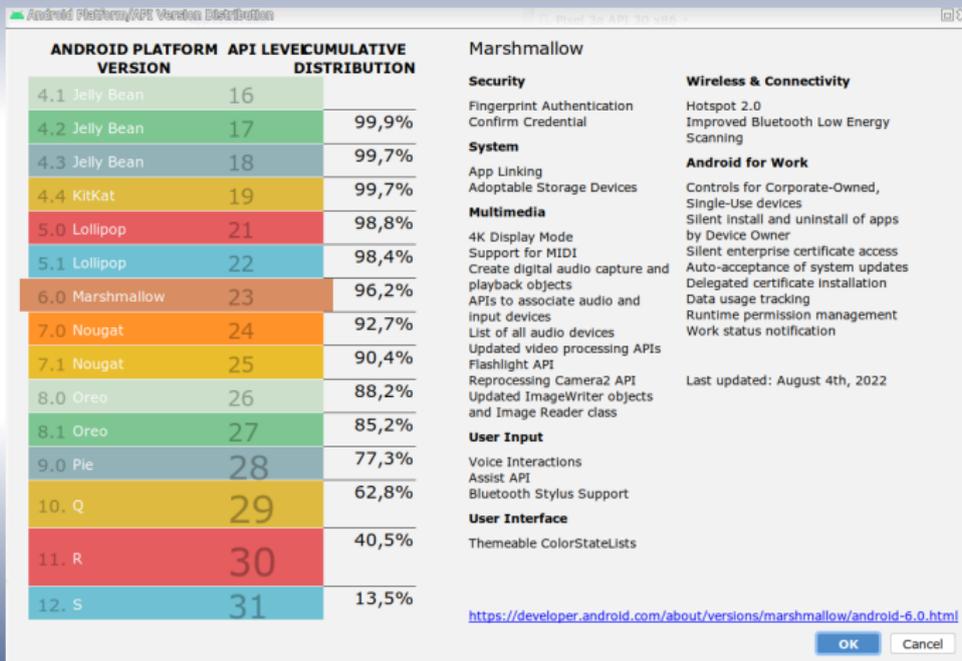
# Diffusion

## Google I/O, mai 2019



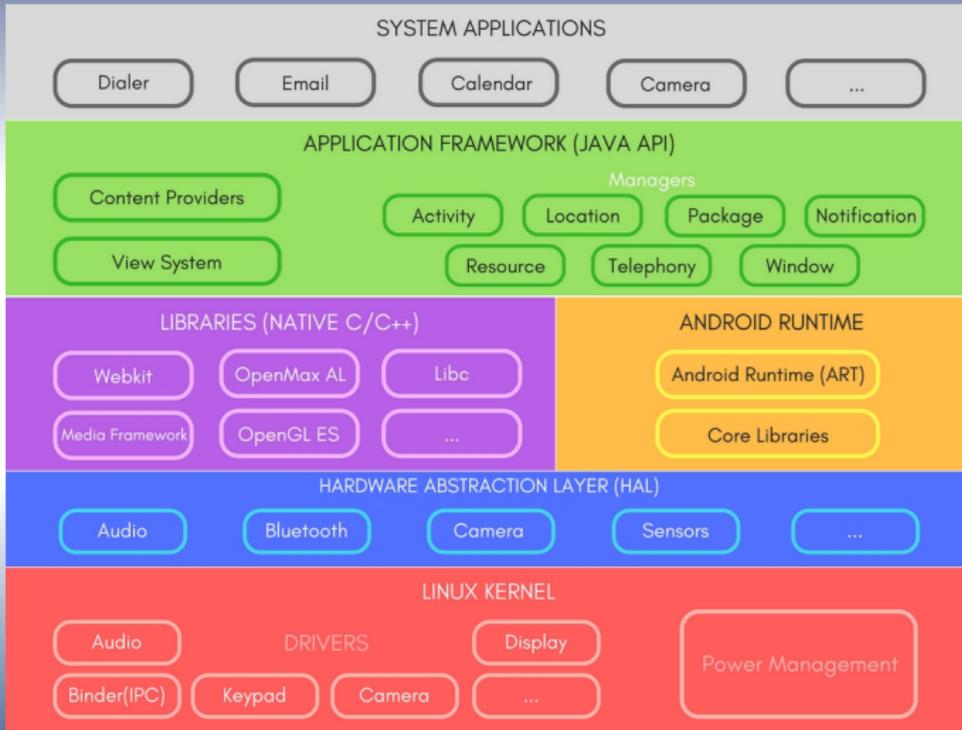


# Nombre d'utilisateurs des différentes versions (accès au Play Store)





# Architecture globale





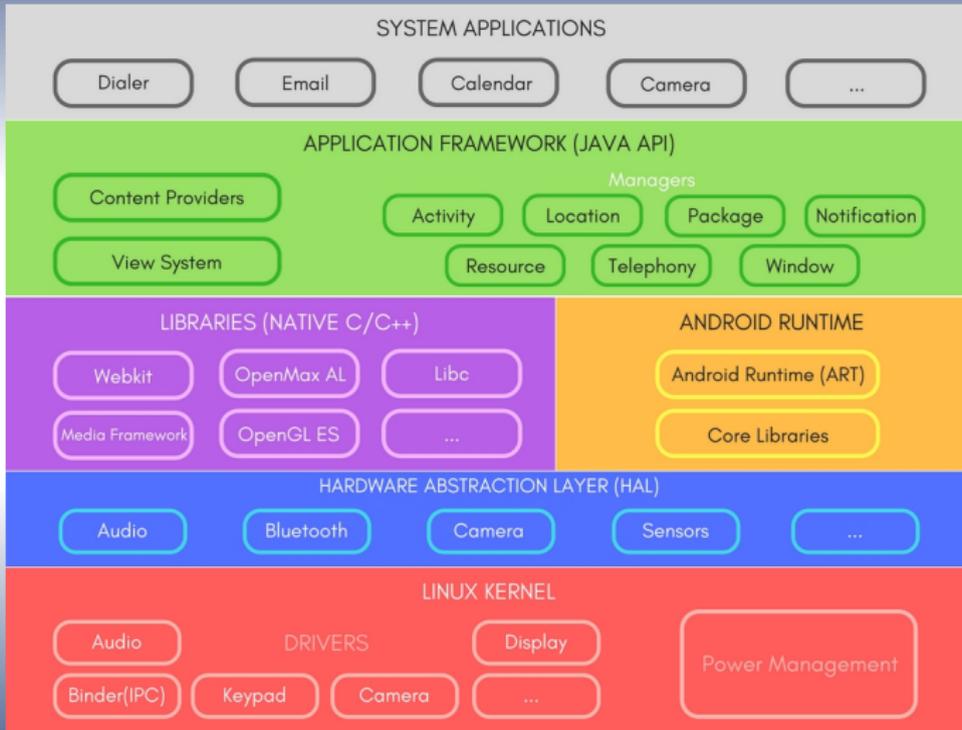
# Libraries

## Librairies C/C++ libres ⇒

- **Surface Manager** : affichage 2D/3D
- **Media Framework** : codecs basés sur librairie OpenCORE
- **SQLite** : moteur de base de données relationnelle
- **OpenGL—ES** : implémentation OpenGL pour l'embarqué
- **FreeType** : rendu bitmap de polices vectorielles
- **WebKit** : moteur de rendu de pages Web
- **SGL** : moteur graphique 2D
- **SSL** : communications réseaux sécurisées
- **libc** : dérivé de la librairie C (BSD) pour l'embarqué (Bionic libc)



# Architecture : Application Framework





# Application framework 1/2

## Modules ⇒

- **Content Providers** : gestion de l'accès aux données (appli et autres applis)
- **View System** : gestion des composants graphiques et des événements utilisateurs liés
- **Activity Manager** : cycle de vie et navigation entre applications
- **Location Manager** : accès aux fonctions de localisation



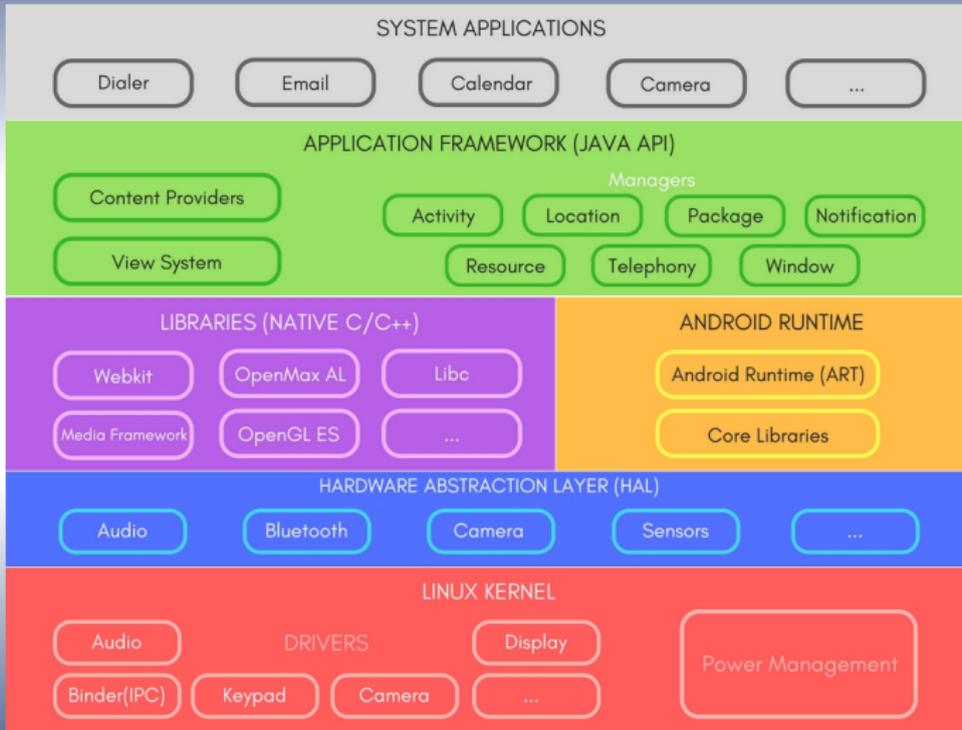
## Application framework 2/2

### Modules ⇒

- **Package Manager** : accès aux API tierces installées
- **Notification Manager** : gestion du système de notifications
- **Resource Manager** : gestion des ressources (images, définition des layouts, etc.)
- **Telephony Manager** : accès aux services de téléphonie
- **Window Manager** : gestion GUI (z-ordered, mise en page, etc.)



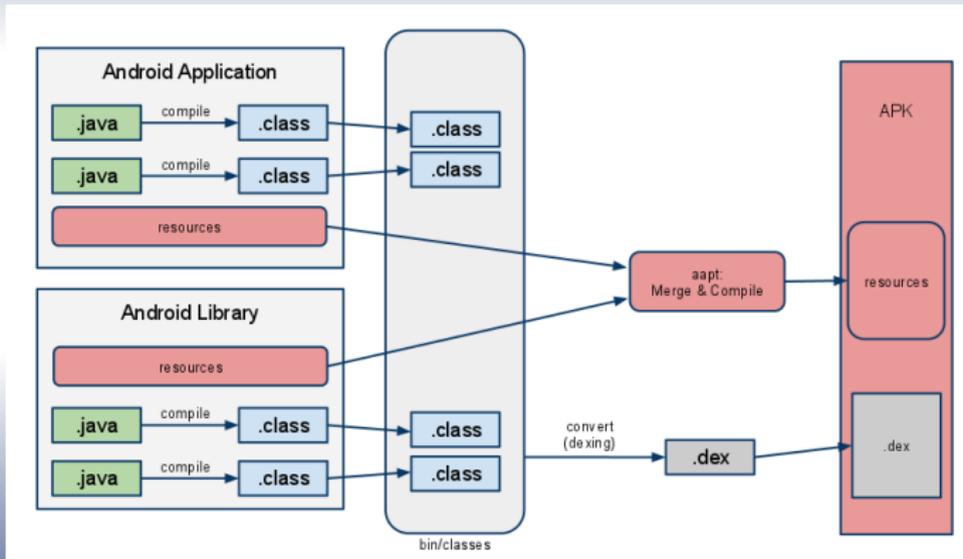
# Architecture : Android Runtime





# Construction d'un APK

**APK : Android package**, archive contenant les ressources nécessaires à l'exécution d'une application Android





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# Prérequis pour créer une application Android :

## Connaissances Techniques

- Android (runtime + framework) ⇒ **POO + Java** / Kotlin

## Android *Command line tools*

- Android **SDK Manager**
- **Android Virtual Device** Manager (AVD)
- **Android Debug Bridge** (adb) ...

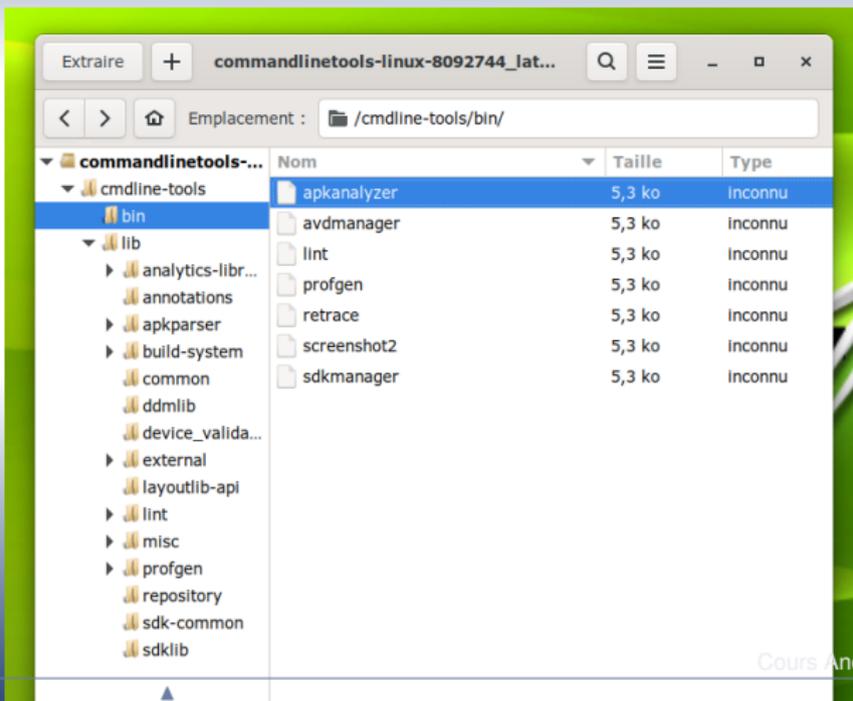
## Un IDE

- **Android Studio** [▸ téléchargement](#) / Eclipse



## Command line tools (archive zip)

Décompression dans un répertoire, e.g. Android-sdk.  
Répertoire référencé **SDK\_PATH** dans la suite





# SDK Manager

## Onglet SDK tools

Settings

Appearance & Behavior > System Settings > Android SDK Reset

Manager for the Android SDK and Tools used by the IDE

Android SDK Location:  Edit Optimize disk space

SDK Platforms SDK Tools SDK Update Sites

Below are the available SDK developer tools. Once installed, the IDE will automatically check for updates. Check "show package details" to display available versions of an SDK Tool.

Name	Version	Status
<input checked="" type="checkbox"/> Android SDK Build-Tools 32.1-rc1		Installed
<input type="checkbox"/> NDK (Side by side)		Not Installed
<input type="checkbox"/> Android SDK Command-line Tools (latest)		Not Installed
<input type="checkbox"/> CMake		Not Installed
<input type="checkbox"/> Android Auto API Simulators	1	Not installed
<input type="checkbox"/> Android Auto Desktop Head Unit Emulator	1.1	Not installed
<input checked="" type="checkbox"/> Android Emulator	30.4.5	Update Available: 31.2.8
<input checked="" type="checkbox"/> Android SDK Platform-Tools	31.0.0	Update Available: 32.0.0
<input type="checkbox"/> Google Play APK Expansion library	1	Not installed
<input type="checkbox"/> Google Play Instant Development SDK	1.9.0	Not installed
<input type="checkbox"/> Google Play Licensing Library	1	Not installed
<input type="checkbox"/> Google Play services	49	Not installed
<input type="checkbox"/> Google Web Driver	2	Not installed
<input type="checkbox"/> Layout Inspector image server for API 29-30	6	Not installed
<input type="checkbox"/> Layout Inspector image server for API S	3	Not installed

Hide Obsolete Packages  Show Package Details

OK Cancel Apply

? Project-level settings will be applied to new projects



# SDK Manager

## Onglet SDK platform : APIs Android

Settings

Appearance & Behavior > System Settings > Android SDK

Manager for the Android SDK and Tools used by the IDE

Android SDK Location:  [Edit](#) [Optimize disk space](#)

[SDK Platforms](#) [SDK Tools](#) [SDK Update Sites](#)

Each Android SDK Platform package includes the Android platform and sources pertaining to an API level by default. Once installed, the IDE will automatically check for updates. Check "show package details" to display individual SDK components.

Name	API Level	Revision	Status
<input type="checkbox"/> Android API 32	32	1	Not installed
<input type="checkbox"/> Android 12.0 (S)	31	1	Not installed
<input type="checkbox"/> Android 11.0 (R)	30	3	Update available
<input checked="" type="checkbox"/> Android 10.0 (Q)	29	5	Installed
<input type="checkbox"/> Android 9.0 (Pie)	28	6	Not installed
<input type="checkbox"/> Android 8.1 (Oreo)	27	3	Partially installed
<input type="checkbox"/> Android 8.0 (Oreo)	26	2	Not installed
<input type="checkbox"/> Android 7.1.1 (Nougat)	25	3	Not installed
<input type="checkbox"/> Android 7.0 (Nougat)	24	2	Not installed
<input type="checkbox"/> Android 6.0 (Marshmallow)	23	3	Not installed
<input type="checkbox"/> Android 5.1 (Lollipop)	22	2	Not installed
<input type="checkbox"/> Android 5.0 (Lollipop)	21	2	Not installed
<input type="checkbox"/> Android 4.4W (KITKat Wear)	20	2	Not installed
<input checked="" type="checkbox"/> Android 4.4 (KitKat)	19	4	Installed
<input type="checkbox"/> Android 4.3 (Jelly Bean)	18	3	Not installed
<input type="checkbox"/> Android 4.2 (Jelly Bean)	17	3	Not installed
<input type="checkbox"/> Android 4.1 (Jelly Bean)	16	5	Not installed
<input type="checkbox"/> Android 4.0.3 (IceCreamSandwich)	15	5	Not installed
<input type="checkbox"/> Android 4.0 (IceCreamSandwich)	14	4	Not installed
<input type="checkbox"/> Android 3.2 (Honeycomb)	13	1	Not installed

Hide Obsolete Packages  Show Package Details

? Project-level settings will be applied to new projects

[OK](#) [Cancel](#) [Apply](#)



# Android Virtual Device Manager (AVD)

Android Virtual Device (AVD) Manager

Android Virtual Devices | Device Definitions

List of existing Android Virtual Devices located at /home/fab/.android/avd

AVD Name	Target Name	Platform	API Level	CPU/ABI	Create...
NEXUS_7	Android 4.4W.2	4.4W.2	20	Android Wear Intel Atom (x86)	Start...
nexus_s	Android 4.4W.2	4.4W.2	20	Android Wear ARM (armeabi-v7a)	Edit...

Repair...  
Delete...  
Details...  
Refresh

A repairable Android Virtual Device. An Android Virtual Device that failed to load. Click 'Details' to see the error.



# Outils requis

IDE pour programmer une application Android :

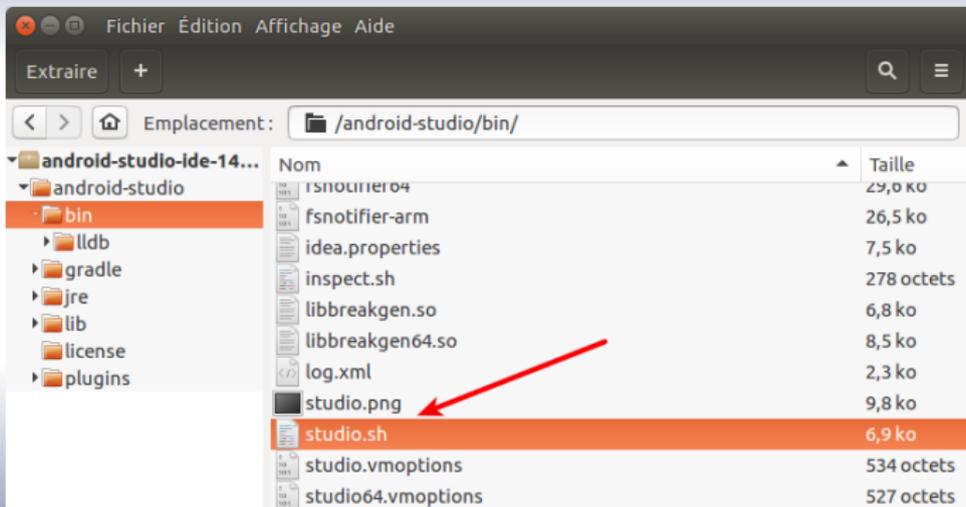
## 2 solutions :

- Eclipse avec le plugin **Andmore** :
  - ▶ taper android dans le marketplace d'Eclipse
- **Android Studio** (supporté par Google) :
  - ▶ <https://developer.android.com/studio>



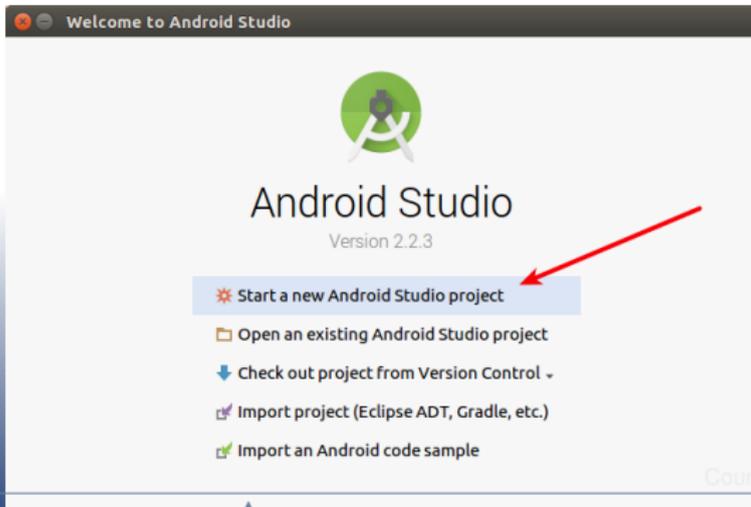
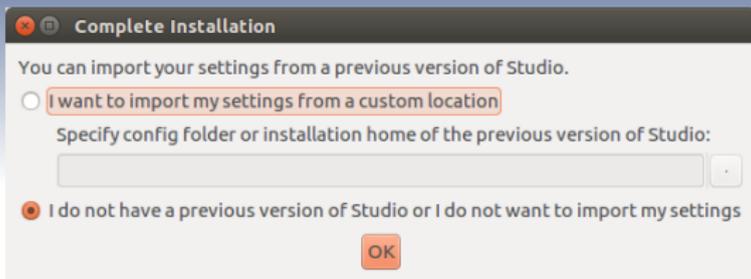
# Android Studio

Contenu de l'archive (téléchargera tout le reste : tools, sdk, etc.)





# Android Studio





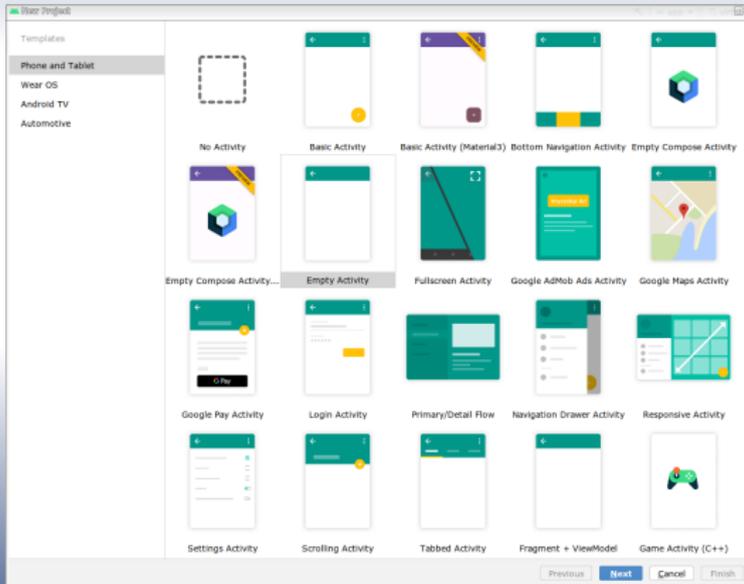
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# New project 1

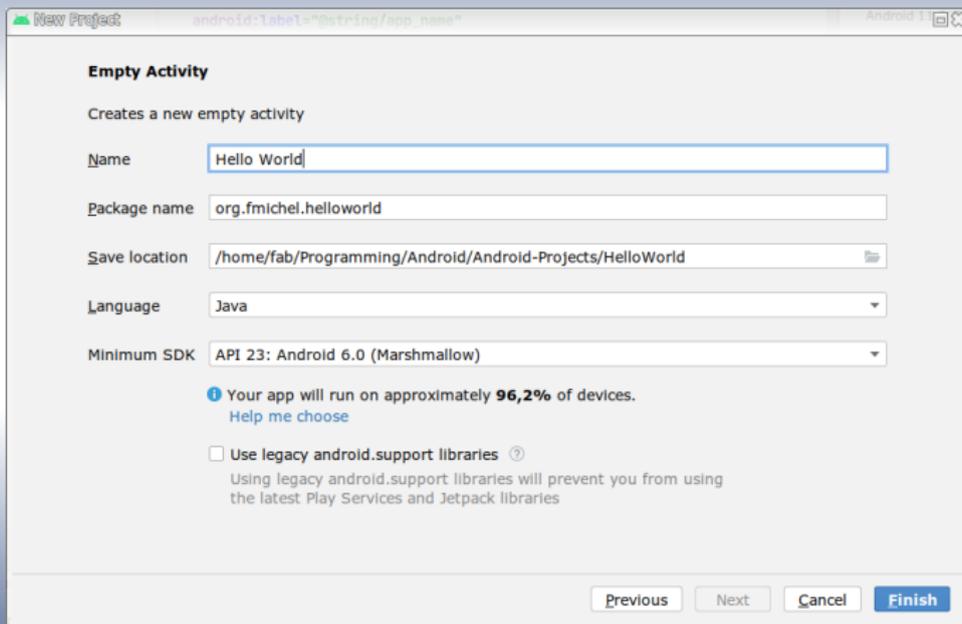
## Choix du squelette de l'activité principale





# New project 2

## Caractéristiques principales

The screenshot shows the 'New Project' dialog box in Android Studio. The title bar reads 'New Project' and 'Android Studio'. The main content area is titled 'Empty Activity' and includes the instruction 'Creates a new empty activity'. There are several input fields: 'Name' with the text 'Hello World', 'Package name' with 'org.fmichel.helloworld', 'Save location' with '/home/fab/Programming/Android/Android-Projects/HelloWorld', 'Language' set to 'Java', and 'Minimum SDK' set to 'API 23: Android 6.0 (Marshmallow)'. Below these fields, there is a blue information icon followed by the text 'Your app will run on approximately 96,2% of devices.' and a link 'Help me choose'. There is also an unchecked checkbox for 'Use legacy android.support libraries' with a help icon and a note that using these libraries prevents the use of the latest Play Services and Jetpack libraries. At the bottom right, there are four buttons: 'Previous', 'Next', 'Cancel', and 'Finish'.



# New project 3

## Sélection de l'API Minimum

Android Platform/API Version Distribution

ANDROID PLATFORM VERSION	API LEVEL	CUMULATIVE DISTRIBUTION
4.1 Jelly Bean	16	
4.2 Jelly Bean	17	99,9%
4.3 Jelly Bean	18	99,7%
4.4 KitKat	19	99,7%
5.0 Lollipop	21	98,8%
5.1 Lollipop	22	98,4%
6.0 Marshmallow	23	96,2%
7.0 Nougat	24	92,7%
7.1 Nougat	25	90,4%
8.0 Oreo	26	88,2%
8.1 Oreo	27	85,2%
9.0 Pie	28	77,3%
10. Q	29	62,8%
11. R	30	40,5%
12. S	31	13,5%

**Lollipop**

**User Interface**

- Material design support
- Concurrent documents and activities in the recents screen
- WebView updates
- Screen capturing and sharing

**Notifications**

- Lock screen notifications
- Notifications metadata

**Graphics**

- Support for OpenGL ES 3.1
- Android Extension Pack

**Media**

- Camera API for advanced camera capabilities
- Audio playback
- Media playback control
- Media browsing

**Storage**

- Directory selection

**Wireless & Connectivity**

- Multiple network connections
- Bluetooth Low Energy
- NFC enhancements

**Battery - Project Volta**

- Scheduling jobs
- Developer tools for battery usage

<https://developer.android.com/about/versions/android-5.0.html>

**Printing Framework**

- Render PDF as bitmap

**System**

- App usage statistics

**Testing & Accessibility**

- Testing and accessibility improvements

**IME**

- Easier switching between input languages

**Manifest Declarations**

- Declarable required features
- User permissions

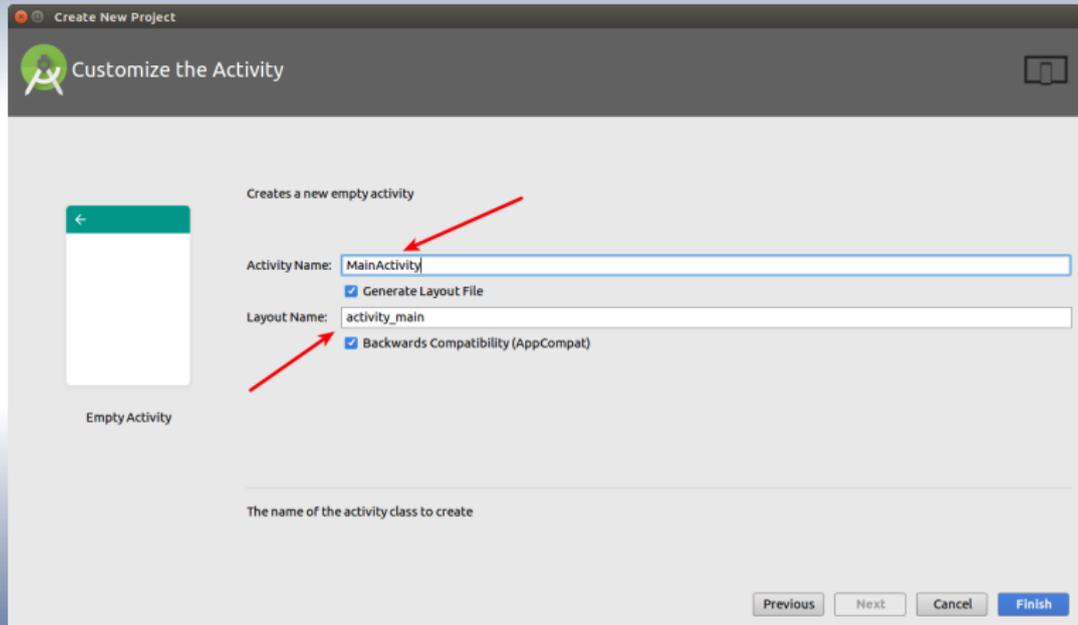
Last updated: August 4th, 2022

OK Cancel



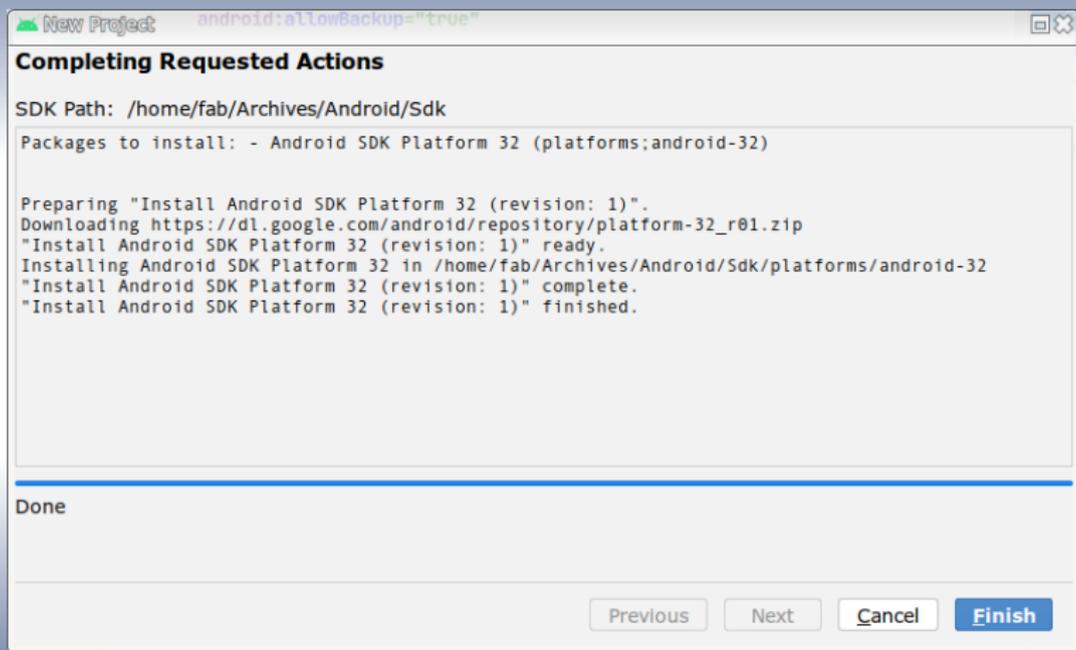
# Paramétrage des noms de fichiers

## Ce choix n'est plus possible...





# Téléchargement de l'API si nécessaire







# Contenu du projet

## Dossier App

- **build/** : fichiers générés par le projet
- **libs/** : bibliothèques additionnelles ("à la main")
- **src/** : intégralité des sources pour le développement (appli + tests)
- **build.gradle** : définition des options du build
- **proguard-rules.pro** : règles additionnelles pour le build
- **.gitignore** : définition des fichiers ignorés par git



# Contenu du projet

## Dossier App/src/

- **androidTest/** : tests de l'application dans l'environnement android
- **test/** : tests internes à l'application
- **main** : sources de l'application
  - **main/java** : sources Java, e.g. la classe qui lance l'activité
  - **main/res** : les ressources de l'application
    - **drawable-(h)(m)(l)dpi/** images dans différentes résolutions
    - **layout/** GUI design général
    - **values/** valeurs des variables
    - **menu/** définition des menus
- **main/AndroidManifest.xml** : description et éléments-clés de l'application (nom, activité principale, intents, etc.)



# app/src/main/AndroidManifest.xml description :

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools">
    <application
        android:allowBackup="true"
        android:dataExtractionRules="@xml/data_extraction_rules"
        android:fullBackupContent="@xml/backup_rules"
        android:icon="@mipmap/ic_launcher"
        android:label="Hello World"
        android:roundIcon="@mipmap/ic_launcher_round"
        android:supportRtl="true"
        android:theme="@style/Theme.HelloWorld"
        tools:targetApi="31">
        <activity
            android:name=".MainActivity"
            android:exported="true">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
            <meta-data
                android:name="android.app.lib_name"
                android:value="" />
        </activity>
    </application>
</manifest>
```



# Manifest complet

```
<?xml version="1.0" encoding="utf-8" ?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    android:versionCode="1"
    android:versionName="1.0"
    package="org.fmiichel.helloworld"
    xmlns:android="http://schemas.android.com/apk/res/android" >
    <uses-sdk
        android:minSdkVersion="23"
        android:targetSdkVersion="32" />
    <application
        android:allowBackup="true"
        android:appComponentFactory="androidx.core.app.CoreComponentFacto
        android:dataExtractionRules="@xml/data_extraction_rules"
        android:fullBackupContent="@xml/backup_rules"
        android:icon="@mipmap/ic_launcher"
        android:label="@string/app_name"
        android:roundIcon="@mipmap/ic_launcher_round"
        android:supportRtl="true"
        android:theme="@style/Theme.HelloWorld" >
        <activity
            android:exported="true"
            android:name="org.fmiichel.helloworld.MainActivity" >
            <intent-filter>
                <action
                    android:name="android.intent.action.MAIN" />
                <category
                    android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
            <meta-data
                android:name="android.app.lib_name"
                android:value="" />
        </activity>
    </application>
</manifest>
```

**Manifest Sources**

- core:1.7.0 manifest
- Hello\_World.app main manifest (this file)
- build.gradle manifest

**Other Manifest Files**  
(Included in merge, but did not contribute any elements)

recyclerview:1.1.0 manifest, lifecycle-livedata-core:2.3.1 manifest, vectordrawable-animated:1.1.0 manifest, viewPager:1.0.0 manifest, appcompat-resources:1.4.1 manifest, constraintlayout:2.1.3 manifest, drawerlayout:1.1.1 manifest, fragment:1.3.6 manifest, versionedparcelable:1.1.1 manifest, documentfile:1.0.0 manifest, material:1.5.0 manifest, localbroadcastmanager:1.0.0 manifest, print:1.0.0 manifest, core-runtime:1.1.0 manifest, legacy-support-core-utils:1.0.0 manifest, dynamicanimation:1.0.0 manifest, cursoradapter:1.0.0 manifest, interpolator:1.0.0 manifest, transition:1.2.0 manifest, viewPager2:1.0.0 manifest, lifecycle-runtime:2.4.0 manifest, lifecycle-livedata:2.0.0 manifest, vectordrawable:1.1.0 manifest, appcompat:1.4.1 manifest, annotation-experimental:1.1.0 manifest, savedstate:1.1.0 manifest, lifecycle-viewmodel-savedstate:2.3.1 manifest, activity:1.2.4 manifest, lifecycle-viewmodel:2.3.1 manifest, loader:1.0.0 manifest, customview:1.1.0 manifest, cardview:1.0.0 manifest, coordinatorlayout:1.1.0 manifest

Text Merged Manifest

Launch succeeded (34 minutes ago)



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## res/layout/activity\_main.xml disposition de la GUI

activity\_main.xml

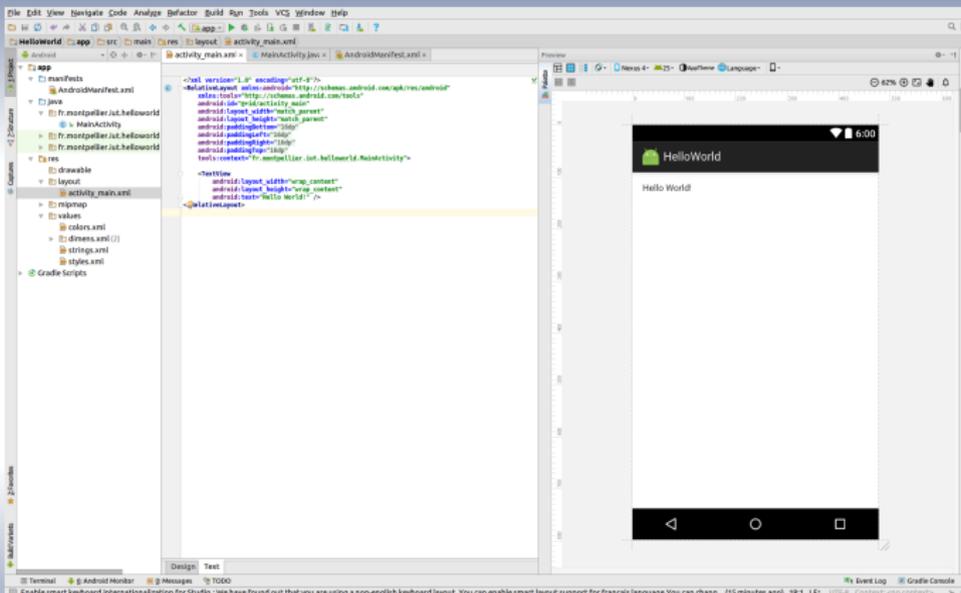
```
<RelativeLayout xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:paddingBottom="@dimen/activity_vertical_margin"
    android:paddingLeft="@dimen/activity_horizontal_margin"
    android:paddingRight="@dimen/activity_horizontal_margin"
    android:paddingTop="@dimen/activity_vertical_margin"
    tools:context="com.example.fr.iutmontp.helloworld.MainActivity" >

    <TextView
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="@string/hello_world" />

</RelativeLayout>
```



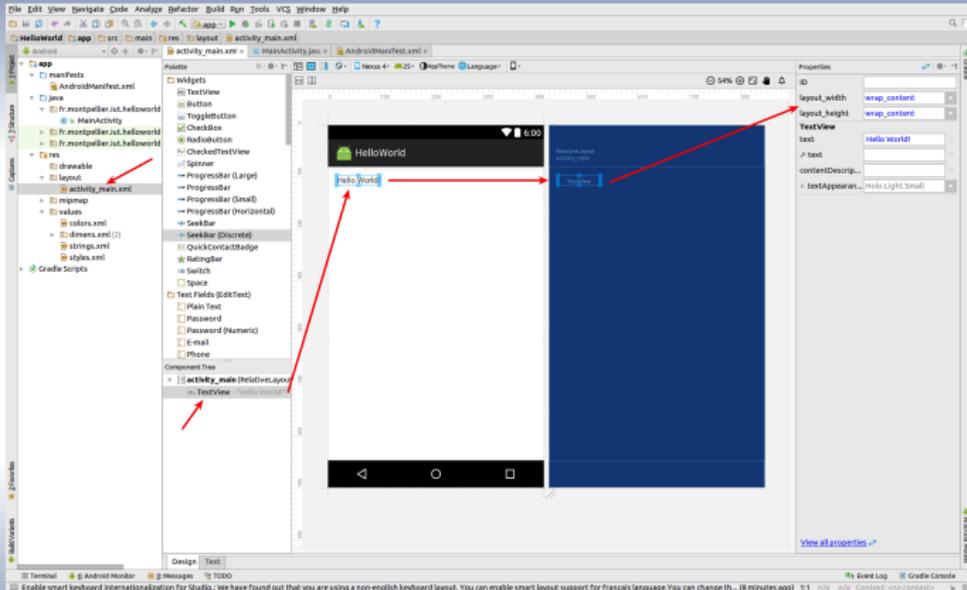
## Éditeur de layout (*text mode*)





Édition du projet avec Android Studio

# Éditeur de layout (*design mode*)





# strings.xml : valeurs des variables

The screenshot shows the Android Studio interface. On the left, the Project view shows the file structure of the 'HelloWorld' app, with 'strings.xml' selected under the 'values' directory. The main Editor view displays the content of 'strings.xml', which contains a single string resource: `<string name="app_name">HelloWorld</string>`. A red arrow points from the 'strings.xml' file in the Project view to the corresponding line in the Editor. Another red arrow points from the 'app\_name' attribute value to the 'Open editor' link in the notification bar above the code. The notification bar also contains a 'Hide notification' link. The bottom status bar shows the current context as '<no context>'.



Édition du projet avec Android Studio

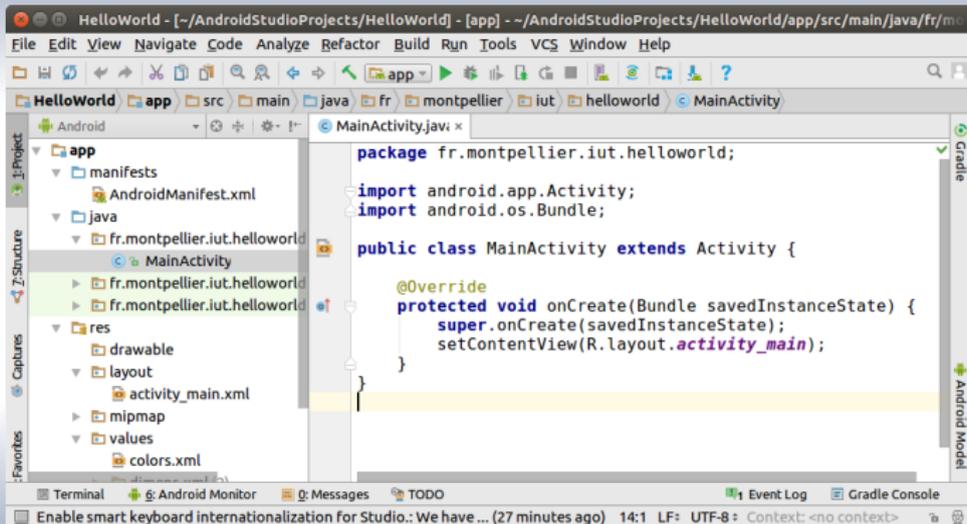
# Éditeur pour *strings.xml*

The screenshot shows the Android Studio interface with the Translations Editor open for the `strings.xml` file. The editor displays a table with columns for Key, Default Value, and Untr... (Untranslated). A red arrow points to the '+' icon in the top left corner of the editor, and another red arrow points to the 'Default Value' column header. The table contains one entry with the key `app_name` and the default value `HelloWorld`. Below the table, there are input fields for Key, Default Value, and Translation.

Key	Default Value	Untr...
<code>app_name</code>	<code>HelloWorld</code>	<input type="checkbox"/>



# */src/././MainActivity.java : activité*



The screenshot shows the Android Studio interface with the MainActivity.java file open. The code is as follows:

```
package fr.montpellier.iut.helloworld;

import android.app.Activity;
import android.os.Bundle;

public class MainActivity extends Activity {

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);
    }
}
```

The interface includes a project tree on the left, a main editor window, and a bottom toolbar with panels for Terminal, Android Monitor, Messages, TODO, Event Log, and Gradle Console.



## `/build/.../R.java` : définition d'identi- fiants

```
Fichier  Édition  Affichage  Rechercher  Outils  Documents  Aide
Ouvrir  [ ]  Enregistrer

/* AUTO-GENERATED FILE.  DO NOT MODIFY.
 *
 * This class was automatically generated by the
 * aapt tool from the resource data it found.  It
 * should not be modified by hand.
 */
package fr.montpellier.iut.helloworld;

public final class R {
    public static final class attr {
    }
    public static final class color {
        public static final int colorAccent=0x7f050000;
        public static final int colorPrimary=0x7f050001;
        public static final int colorPrimaryDark=0x7f050002;
    }
    public static final class dimen {
        public static final int activity_horizontal_margin=0x7f040000;
        public static final int activity_vertical_margin=0x7f040001;
    }
    public static final class id {
        public static final int activity_main=0x7f080000;
    }
    public static final class layout {
```



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## Exécution sur un vrai dispositif

### Mise en place du dispositif pour le développement

- connexion usb : [▶ drivers windows](#) [▶ configuration linux](#)
- sous linux, la commande **lsusb** liste les connexions usb  
[▶ plus d'information](#)
- activation *USB debugging* sur le dispositif :  
à partir de Android 4.2 : Settings → About phone (7 tapes successives).



# Exécution du projet

The screenshot shows the Android Studio interface for a project named 'SharingPicture'. The project structure on the left includes:

- Android > app
  - manifests
    - AndroidManifest.xml
  - java
    - com.example.sharingpicture
      - MainActivity
      - com.example.sharingpicture (androidTest)
      - com.example.sharingpicture (test)
    - java (generated)
    - res
      - drawable
      - layout
      - mipmap
      - raw
        - test.txt
      - values
      - res (generated)
    - Gradle Scripts
      - build.gradle (Project: SharingPicture)
      - build.gradle (Module: SharingPicture.app)
      - gradle-wrapper.properties (Gradle Version)
      - proguard-rules.pro (ProGuard Rules for SharingPicture)

The Device Manager on the right shows two virtual devices:

Device	API	Size on Disk	Actions
Nexus 4 API 30	30	9,8 GB	[Play] [Stop] [Refresh] [Delete]
Pixel_3a_API_30_x86	30	9,9 GB	[Play] [Stop] [Refresh] [Delete]

The Run console at the bottom shows the following output:

```
02/09 18:46:55: Launching 'app' on Nexus 4 API 30.
Install successfully finished in 3 s 95 ms.
Could not identify launch activity: Default Activity not found
Error while Launching activity
Failed to launch an application on all devices
```

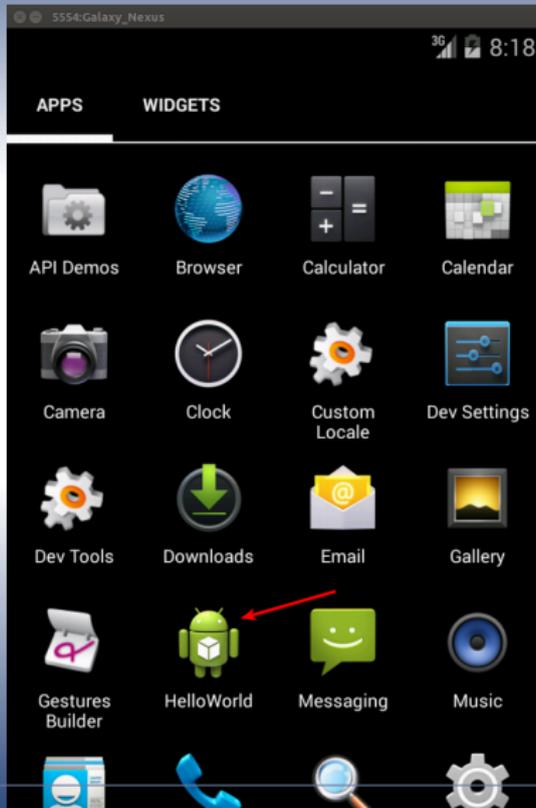
Notifications on the right indicate:

- Project update recommended: Android Gradle Plugin can be upgraded.
- Android Studio and plugin updates available: Components: Android Emulator, Android SDK...

The bottom status bar shows: 7:1 LF UTF-8 4 spaces

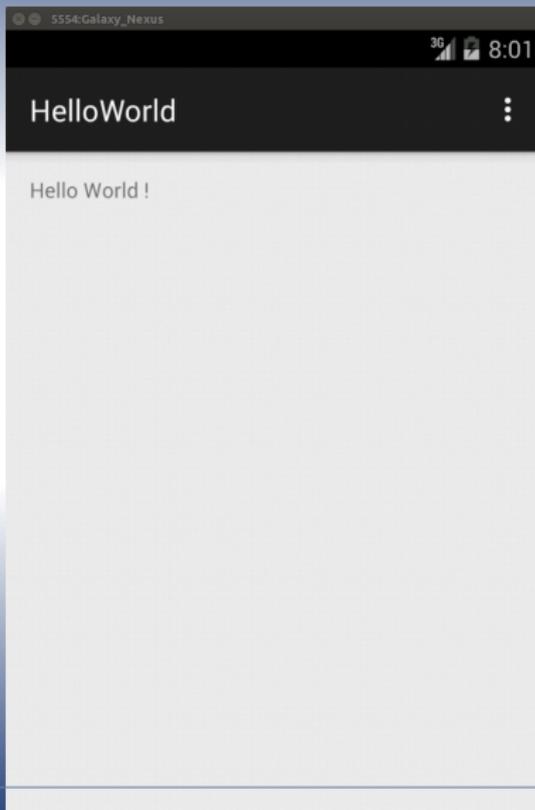


# Une fois déployée



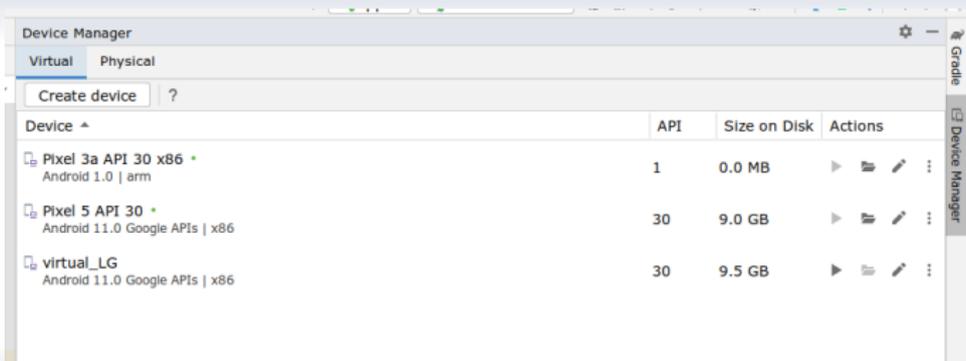


# Résultat →





# Exécution sur un émulateur avec AVD





## Création d'une device virtuelle Choix du modèle

Select Hardware

Choose a device definition

Category	Name	Play Store	Size	Resolution	Density
Phone	Resizable (Experimental)		6,0"	1080x2340	420dpi
Tablet	Pixel XL		5,5"	1440x2560	560dpi
Wear OS	Pixel 6 Pro		6,7"	1440x3120	560dpi
TV	Pixel 6		6,4"	1080x2400	420dpi
Auto...	Pixel 5		6,0"	1080x2340	440dpi
	Pixel 4a		5,8"	1080x2340	440dpi
	Pixel 4 XL		6,3"	1440x3040	560dpi
	Pixel 4	▶	5,7"	1080x2280	440dpi
	Pixel 3a XL		6,0"	1080x2160	400dpi
	Pixel 3a	▶	5,6"	1080x2220	440dpi
	Pixel 3 XL		6,3"	1440x2960	560dpi
	Pixel 3	▶	5,46"	1080x2160	440dpi
	Pixel 2 XL		5,99"	1440x2880	560dpi
	Pixel 2	▶	5,0"	1080x1920	420dpi
	Pixel	▶	5,0"	1080x1920	420dpi
	Nexus 5		4,0"	480x800	hdpi
	Nexus One		3,7"	480x800	hdpi
	Nexus 6P		5,7"	1440x2560	560dpi
	Nexus 6		5,96"	1440x2560	560dpi
	Nexus 5X	▶	5,2"	1080x1920	420dpi
	Nexus 5	▶	4,95"	1080x1920	xhdpi

**Pixel 2**



Size: large  
Ratio: long  
Density: 420dpi

New Hardware Profile   Import Hardware Profiles   Clone Device...

Previous **Next** Cancel Finish



# Choix de l'image système

Virtual Device Configuration

## System Image

Select a system image

Recommended x86 Images Other Images

Release Name	API Level	ABI	Target
Tiramisu $\downarrow$	33	x86_64	Android Tiramisu (Google APIs)
Sv2 $\downarrow$	32	x86_64	Android 12L (Google APIs)
S $\downarrow$	31	x86_64	Android 12.0 (Google APIs)
<b>R</b>	<b>30</b>	<b>x86</b>	<b>Android 11.0 (Google APIs)</b>
Q $\downarrow$	29	x86	Android 10.0 (Google APIs)
Pie $\downarrow$	28	x86	Android 9.0 (Google APIs)
Oreo $\downarrow$	27	x86	Android 8.1 (Google APIs)
Oreo $\downarrow$	26	x86	Android 8.0 (Google APIs)
Nougat $\downarrow$	25	x86	Android 7.1.1 (Google APIs)
Nougat $\downarrow$	24	x86	Android 7.0 (Google APIs)
Marshmallow $\downarrow$	23	x86	Android 6.0 (Google APIs)
Lollipop $\downarrow$	22	x86	Android 5.1 (Google APIs)

**R**



API Level  
**30**

Android  
**11.0**

System Image  
**x86**

We recommend these images because they run the fastest and support Google APIs.

Questions on API level?  
See the [API level distribution chart](#)

Previous Next Cancel Finish



# Paramétrage avancé de la device

The screenshot shows the 'Android Virtual Device (AVD)' configuration window in Android Studio. The window is titled 'Verify Configuration' and contains several sections for configuring the virtual device.

**Verify Configuration**

- AVD Name: Nexus S API 30
- AVD Id: Nexus\_S\_API\_30
- Device: Nexus S, 4.0 480x800 hdpi
- OS: R, Android 11.0 x86
- Startup orientation: Portrait (selected), Landscape
- Camera: Front: Emulated, Back: VirtualScene
- Network: Speed: Full, Latency: None
- Emulated Performance: Graphics: Automatic, Boot option: Quick boot (selected), Multi-Core CPU: 4
- Memory and Storage: RAM: 343 MB, VM heap: 48 MB, Internal Storage: 800 MB

**Graphics Rendering**

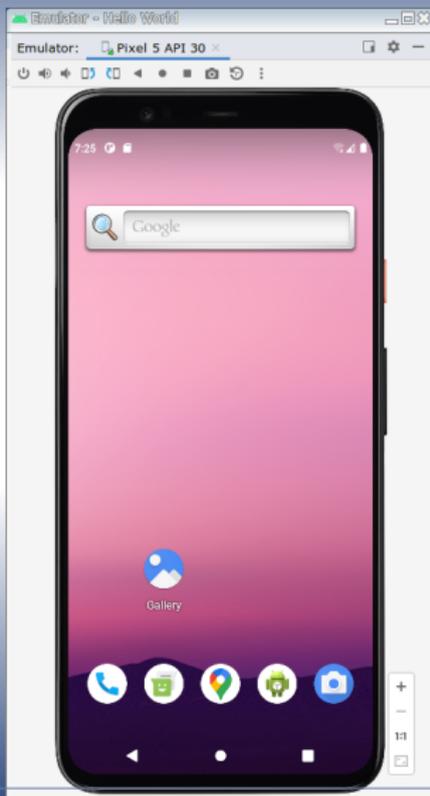
Choose how the graphics should be rendered in the emulator.

- Hardware**: Use your computer's graphics card for faster rendering.
- Software**: Emulate the graphics in software, use this to work around issues with your computer's graphics card.

Buttons at the bottom: Previous, Next, Cancel, Finish.



Start →



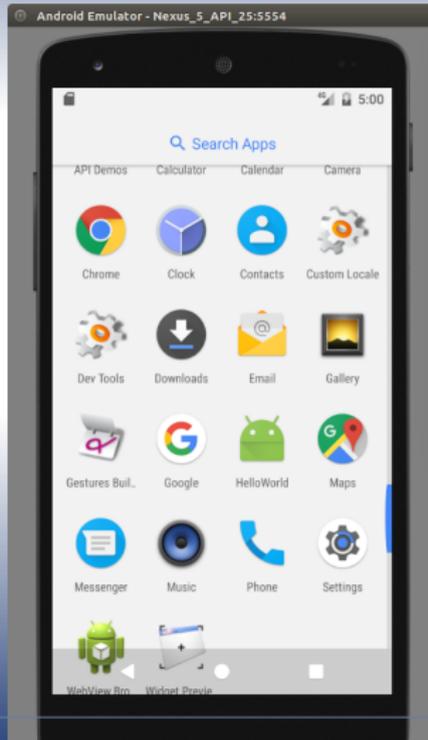


# Exécution du projet sur l'AVD





# L'application est maintenant disponible sur la cible (virtuelle ou non)





# Résumé global

- La technologie Android :
  - Noyau Linux
  - Programmation **Java** / Kotlin
- Programmation Android
  - des outils pour le développement : SDK manager / AVD / un IDE.
  - une structure de projet standardisée (manifest, src, res, etc.)
  - des dispositifs pour le déploiement (virtuels et réels)